Cruise Report
U.S. Geological Survey Research Cruise 2018-622-FA
Santa Barbara Littoral Cell, California
March 27-30, 2018

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USGS

Summary

From March 27 – 30, 2018, the Pacific Coastal and Marine Science Center of the U.S Geological Survey (USGS) conducted single-beam bathymetric surveys in the nearshore waters of the Santa Barbara Littoral Cell (Figure 1). The work was conducted using two Coastal Profiling Systems (CPS) (personal watercraft outfitted with custom GPS and echosounder survey equipment). Watercraft were launched out of Santa Barbara and Ventura Harbors. The survey was the nineteeenth in a series of surveys in this area, starting in October 2005. Bathymetric surveys typically are not performed in the spring, but were performed this year to document the impacts of recent new sediment inputs from area streams during heavy runoff in January and March 2018.

The shoreline of the Santa Barbara Littoral cell consists of a diverse assemblage of sandy, rocky and armored segments with a variety of exposures to waves and currents due to differing degrees of sheltering by offshore islands and nearshore reefs. There are two major river systems (Ventura and Santa Clara) that provide highly variable inputs of terrestrial sediment into the littoral cell. The Santa Clara River is particularly noteworthy as it is the largest source of sediment to southern California nearshore waters. Alongshore transport is driven by wave activity and primarily is from NW to SE, with nearshore sediments ultimately feeding into Mugu Canyon at the southern end of the littoral cell. There is significant development along much of the coastline. Surveys in this region are designed to document coastal evolution on a variety of timescales, from large surf and flood events, to seasonal and decadal, to improve our understanding of the coastal processes that affect shoreline erosion and accretion. Data from these surveys are being used in models of coastal change, including future conditions that include sea level rise and climate change, and to support management of existing coastal resources.

For this survey, a new focus area was added in the Montecito area, between the original Goleta and Carpinteria focus areas, in the region of (and including) 4 previously surveyed BEACON lines (12-15). This new area was added to monitor the coastal response to sediment inputs from catastrophic mudflows and associated storm runoff inputs in the area on January 9, 2018. Survey lines in this area overlap the northernmost extent of the Carpinteria focus area. Survey lines in this focus area are concentrated around creek mouths and in particular in areas previously identified by SWATH mapping in February 2018 as possible nearshore deposition sites. Survey lines also were added in the existing Goleta, Carpinteria and Rincon focus areas at sites where beach nourishment might affect nearshore sediment (Goleta Beach) and at creek mouths and other drainages that experienced significant runoff.

It was determined that the operating frequency of the sonar system (200 kHz) is above the cutoff hearing threshold for marine mammals, therefore the CSLC determined that the observance of a safety zone is not a requirement for this survey (personal communications, K. Keen, CSLC), and that a marine wildlife monitor (MWO) was not required due to operational limitations of the personal watercraft used.

USGS research cruise 2018-622-FA took place over 4 consecutive days from March 27-30, 2018. The Carpinteria focus area was surveyed on 3/27, with a few of the northernmost Rincon-area lines. The Montecito area was surveyed on 3/28, with Ventura surveyed on 3/29 and Goleta on 3/30. All operations, including transits and surveying, took place during daylight hours (0630 – 1300). Mapping was completed using hull-mounted 200-kHz , Odom 9 degree downward conical beam transducers and Odom Echotrac CV100 echo sounders at survey speeds of ~4 knots. Weather observations are provided in Appendix A and marine wildlife observations in Appendix B. As-surveyed track lines are shown in Figures 2-5, with start and end locations listed in Tables 1-10.

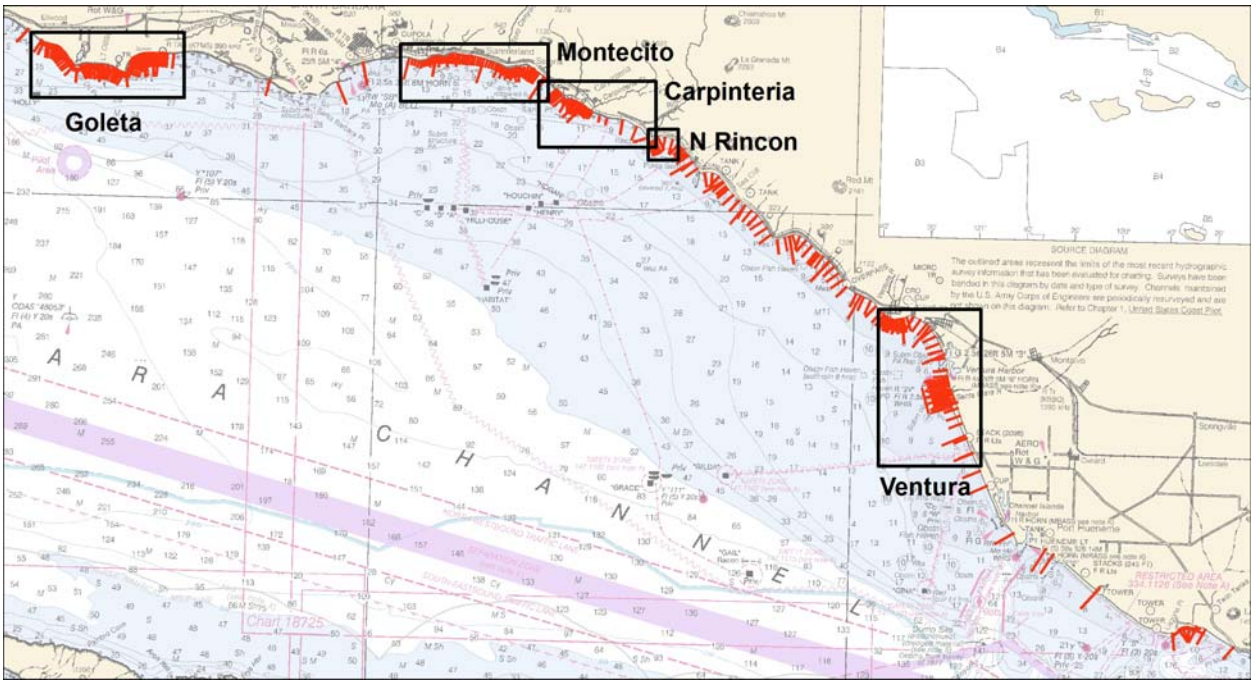

Figure 1. Overview of Santa Barbara Littoral Cell study area and planned Spring 2018 survey lines in five focus areas. Longer lines in and between focus areas are BEACON lines, which are surveyed in the Fall in odd years. Lines south of the Ventura focus area are BEACON and Mugu focus area lines that were not surveyed.

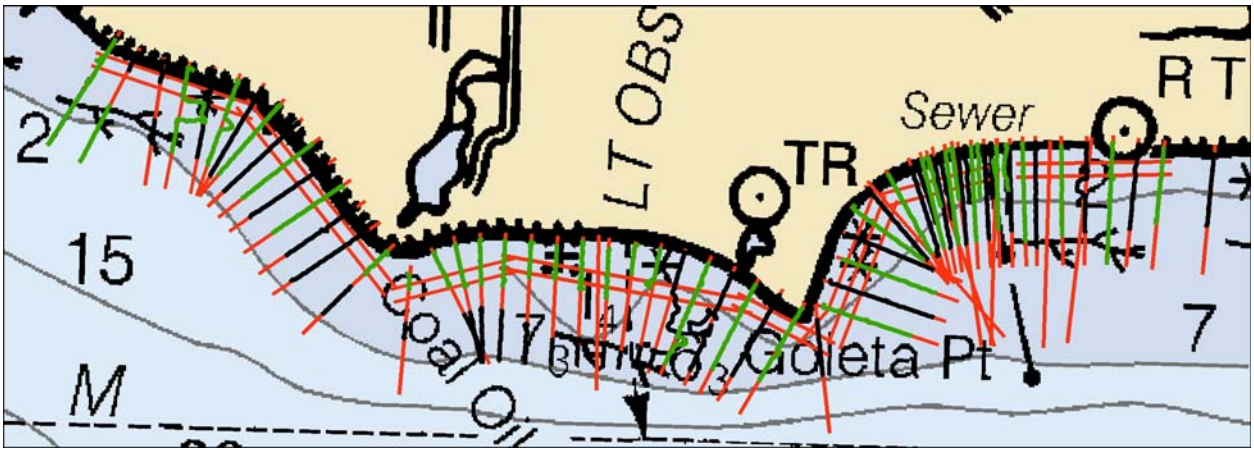

Figure 2. As-surveyed lines, Goleta area. Target lines are in red, surveyed lines are in black for black PWC, green for green PWC.

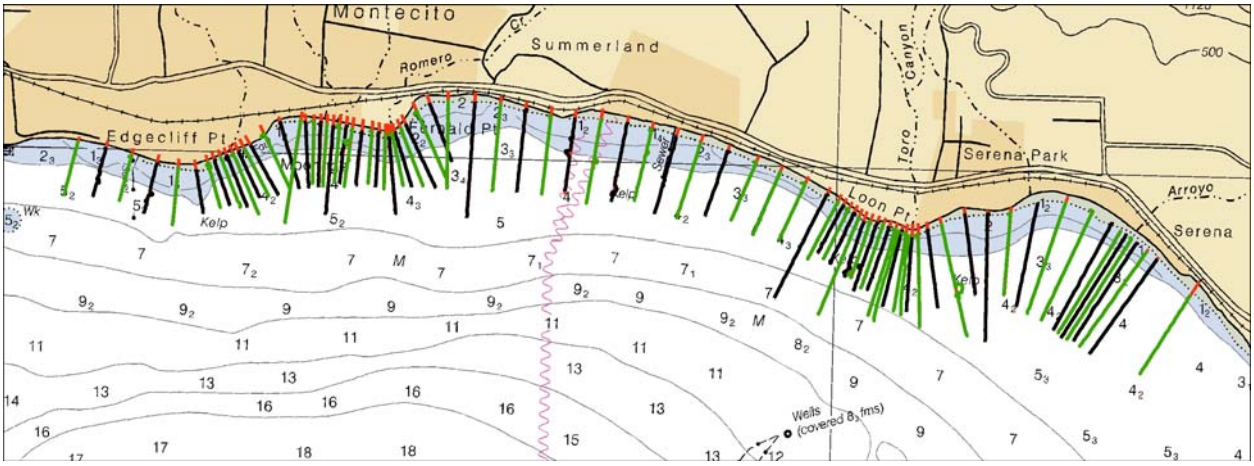

Figure 3. As-surveyed lines, Montecito area. Target lines are in red, surveyed lines are in black for black PWC, green for green PWC.

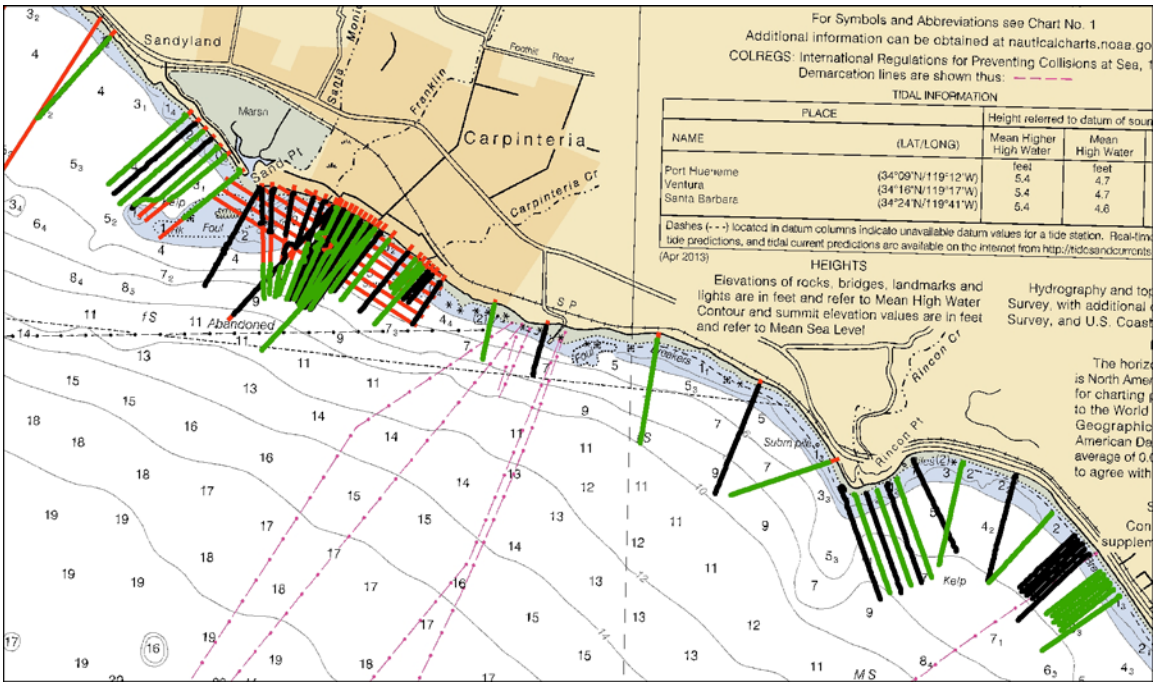

Figure 4. As-surveyed lines, Carpinteria area and northernmost lines in the Rincon area. Target lines are in red, surveyed lines are in black for black PWC, green for green PWC.

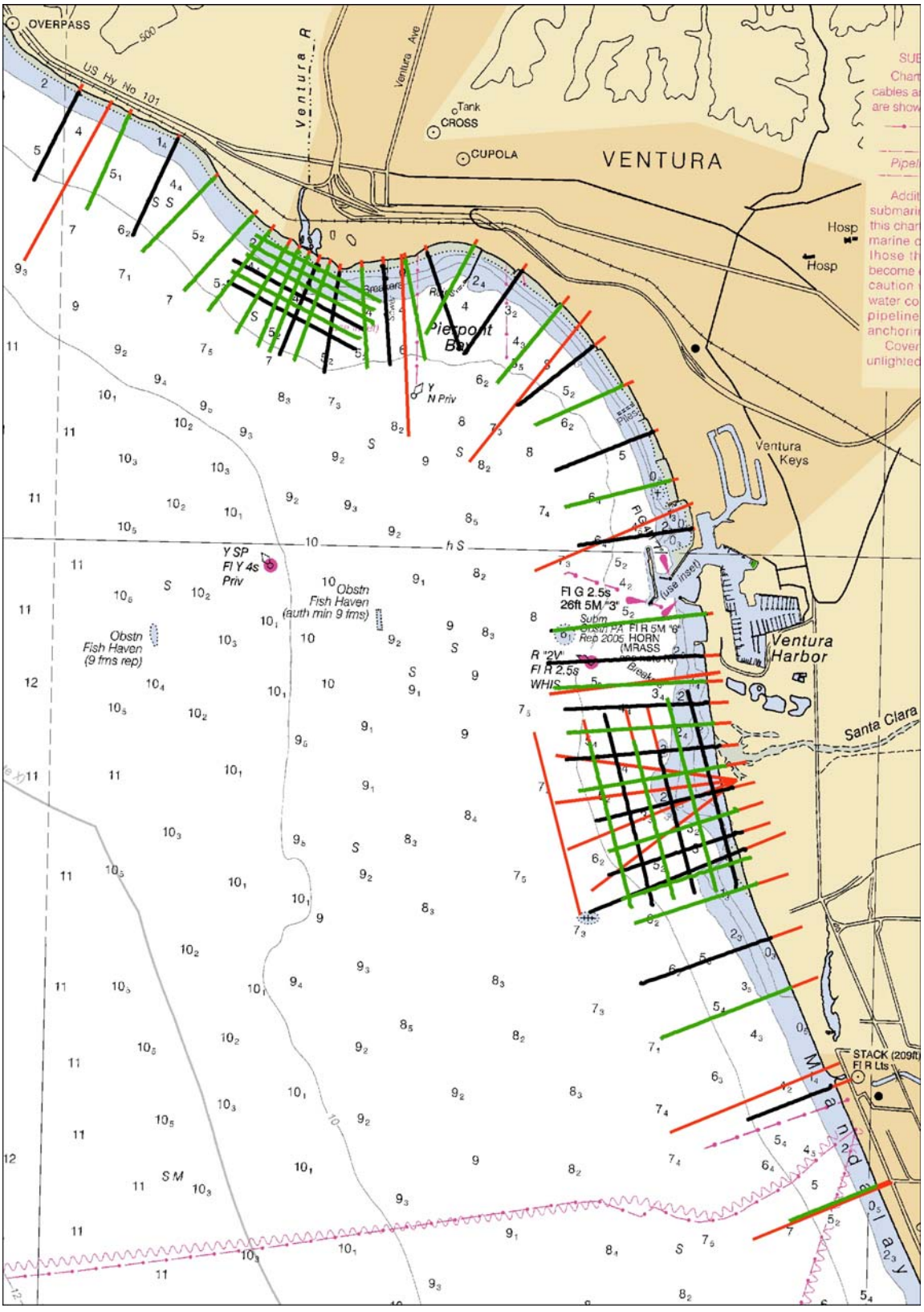

Figure 5. As-surveyed lines, Ventura area. Target lines are in red, surveyed lines are in black for black PWC, green for green PWC.

Table 1. As-surveyed line endpoints, Goleta, Black PWC

	Start			End		
Line	Date/time (PDT)	Lat	Lon	Date/time (PDT)	Lat	Lon
000_0736.RAW	3/29/2018 7:36	34.411284	-119.811711	3/29/2018 7:39	34.416444	-119.811187
002_0745.RAW	3/29/2018 7:45	34.41689	-119.817471	3/29/2018 7:49	34.410944	-119.818134
004_0750.RAW	3/29/2018 7:50	34.410653	-119.821819	3/29/2018 7:55	34.417038	-119.821938
006_0757.RAW	3/29/2018 7:57	34.416778	-119.826161	3/29/2018 8:01	34.409503	-119.825876
008_0803.RAW	3/29/2018 8:03	34.410579	-119.827961	3/29/2018 8:08	34.416665	-119.828385
010_0810.RAW	3/29/2018 8:10	34.416652	-119.829874	3/29/2018 8:13	34.41286	-119.829645
010_0814.RAW	3/29/2018 8:14	34.41003	-119.829887	3/29/2018 8:18	34.416631	-119.830529
012_0819.RAW	3/29/2018 8:19	34.416391	-119.832016	3/29/2018 8:22	34.412428	-119.831547
012_0823.RAW	3/29/2018 8:23	34.409631	-119.831711	3/29/2018 8:27	34.416354	-119.832696
014_0829.RAW	3/29/2018 8:29	34.415757	-119.834053	3/29/2018 8:32	34.411269	-119.833014
014_0832.RAW	3/29/2018 8:32	34.409339	-119.833046	3/29/2018 8:36	34.415699	-119.834714
016_0838.RAW	3/29/2018 8:38	34.415096	-119.835994	3/29/2018 8:41	34.411076	-119.834323
016_0843.RAW	3/29/2018 8:43	34.408811	-119.834229	3/29/2018 8:47	34.414955	-119.836566
018_0849.RAW	3/29/2018 8:49	34.413269	-119.840073	3/29/2018 8:53	34.408498	-119.834934
020_0854.RAW	3/29/2018 8:54	34.407779	-119.834405	3/29/2018 8:58	34.410174	-119.841825
022_0900.RAW	3/29/2018 9:00	34.406873	-119.842906	3/29/2018 9:06	34.40452	-119.834311
024_0908.RAW	3/29/2018 9:08	34.400208	-119.843416	3/29/2018 9:10	34.404224	-119.844105
026_0912.RAW	3/29/2018 9:12	34.405617	-119.847304	3/29/2018 9:16	34.400044	-119.851119
028_0917.RAW	3/29/2018 9:17	34.400269	-119.854539	3/29/2018 9:27	34.407309	-119.851248
030_0929.RAW	3/29/2018 9:29	34.408426	-119.855282	3/29/2018 9:36	34.400475	-119.858016
031_0941.RAW	3/29/2018 9:41	34.400401	-119.859127	3/29/2018 9:42	34.401901	-119.858742
032_0943.RAW	3/29/2018 9:43	34.401436	-119.860515	3/29/2018 9:44	34.400272	-119.860597
033_0944.RAW	3/29/2018 9:44	34.400377	-119.861892	3/29/2018 9:45	34.402213	-119.861859
034_0946.RAW	3/29/2018 9:46	34.402267	-119.86399	3/29/2018 9:48	34.40043	-119.864101
035_0949.RAW	3/29/2018 9:49	34.400406	-119.866237	3/29/2018 9:50	34.40229	-119.866216
036_0951.RAW	3/29/2018 9:51	34.403091	-119.868197	3/29/2018 9:54	34.400493	-119.868474
037_0955.RAW	3/29/2018 9:55	34.400645	-119.870492	3/29/2018 9:57	34.404222	-119.870533
038_0958.RAW	3/29/2018 9:58	34.404338	-119.872156	3/29/2018 10:01	34.400411	-119.871968
039_1001.RAW	3/29/2018 10:01	34.400527	-119.87208	3/29/2018 10:03	34.404007	-119.873185
040_1004.RAW	3/29/2018 10:04	34.401712	-119.872229	3/29/2018 10:06	34.403855	-119.873654
041_1008.RAW	3/29/2018 10:08	34.401969	-119.878496	3/29/2018 10:09	34.403079	-119.878581
042_1011.RAW	3/29/2018 10:11	34.405425	-119.883199	3/29/2018 10:13	34.40356	-119.885517
043_1014.RAW	3/29/2018 10:14	34.405726	-119.88823	3/29/2018 10:19	34.409542	-119.88179
044_1020.RAW	3/29/2018 10:20	34.410856	-119.883143	3/29/2018 10:26	34.407532	-119.88874
046_1027.RAW	3/29/2018 10:27	34.410072	-119.891853	3/29/2018 10:31	34.414025	-119.885498
048_1032.RAW	3/29/2018 10:32	34.416674	-119.88806	3/29/2018 10:36	34.411864	-119.89413
050_1037.RAW	3/29/2018 10:37	34.412885	-119.895269	3/29/2018 10:41	34.419068	-119.891249
052_1044.RAW	3/29/2018 10:44	34.420137	-119.895108	3/29/2018 10:49	34.414057	-119.896378

054_1050.RAW	3/29/2018 10:50	34.414929	-119.900179	3/29/2018 10:51	34.41675	-119.899988
053_1055.RAW	3/29/2018 10:55	34.418346	-119.897758	3/29/2018 10:56	34.420322	-119.897329
054_1057.RAW	3/29/2018 10:57	34.420704	-119.899308	3/29/2018 10:59	34.419261	-119.89961
055_1101.RAW	3/29/2018 11:01	34.421263	-119.901588	3/29/2018 11:02	34.420041	-119.90236
056_1103.RAW	3/29/2018 11:03	34.422098	-119.903475	3/29/2018 11:05	34.420652	-119.904679
056_1105.RAW	3/29/2018 11:05	34.419188	-119.9056	3/29/2018 11:09	34.415016	-119.908715

Table 2. As-surveyed line endpoints, Goleta, Green PWC

	Start			End		
Line	Date/time (PDT)	Lat	Lon	Date/time (PDT)	Lat	Lon
001_0737.RAW	3/29/2018 7:37	34.411432	-119.815995	3/29/2018 7:40	34.416809	-119.815439
003_0741.RAW	3/29/2018 7:41	34.41693	-119.819618	3/29/2018 7:47	34.408503	-119.819937
005_0754.RAW	3/29/2018 7:54	34.410482	-119.823827	3/29/2018 7:58	34.416737	-119.824034
007_0759.RAW	3/29/2018 7:59	34.416766	-119.827171	3/29/2018 8:03	34.409866	-119.826802
009_0805.RAW	3/29/2018 8:05	34.410633	-119.829107	3/29/2018 8:10	34.416658	-119.829465
009_0811.RAW	3/29/2018 8:10	34.416681	-119.828696	3/29/2018 8:15	34.413389	-119.828338
011_0817.RAW	3/29/2018 8:17	34.409884	-119.830955	3/29/2018 8:20	34.416574	-119.831605
011_0821.RAW	3/29/2018 8:21	34.416611	-119.831168	3/29/2018 8:23	34.412861	-119.83067
013_0825.RAW	3/29/2018 8:25	34.409635	-119.832414	3/29/2018 8:29	34.416071	-119.833722
013_0829.RAW	3/29/2018 8:29	34.416101	-119.833626	3/29/2018 8:31	34.412658	-119.832488
015_0833.RAW	3/29/2018 8:33	34.409347	-119.833626	3/29/2018 8:36	34.41551	-119.835704
015_0846.RAW	3/29/2018 8:46	34.415415	-119.835642	3/29/2018 8:49	34.412126	-119.833968
017_0851.RAW	3/29/2018 8:51	34.40892	-119.834651	3/29/2018 8:55	34.414373	-119.838479
019_0856.RAW	3/29/2018 8:56	34.412181	-119.841171	3/29/2018 9:00	34.408478	-119.835281
021_0901.RAW	3/29/2018 9:01	34.406253	-119.834074	3/29/2018 9:05	34.408409	-119.842123
023_0910.RAW	3/29/2018 9:10	34.405279	-119.84349	3/29/2018 9:14	34.403201	-119.836096
025_0916.RAW	3/29/2018 9:16	34.404756	-119.845263	3/29/2018 9:20	34.399761	-119.848815
027_0922.RAW	3/29/2018 9:22	34.400418	-119.852777	3/29/2018 9:27	34.406525	-119.849264
029_0928.RAW	3/29/2018 9:28	34.407817	-119.85324	3/29/2018 9:34	34.400688	-119.856752
031_0941.RAW	3/29/2018 9:41	34.405946	-119.858104	3/29/2018 9:43	34.408813	-119.857363
032_0944.RAW	3/29/2018 9:44	34.408939	-119.85916	3/29/2018 9:45	34.407938	-119.859684
032_0946.RAW	3/29/2018 9:46	34.408082	-119.859744	3/29/2018 9:47	34.406901	-119.859788
034_0948.RAW	3/29/2018 9:48	34.40591	-119.8636	3/29/2018 9:51	34.409162	-119.863873
033_0952.RAW	3/29/2018 9:52	34.408713	-119.86168	3/29/2018 9:55	34.405156	-119.861803
035_0956.RAW	3/29/2018 9:56	34.406477	-119.865946	3/29/2018 9:58	34.408854	-119.866073
036_0959.RAW	3/29/2018 9:59	34.408828	-119.867918	3/29/2018 10:01	34.406365	-119.868281
037_1002.RAW	3/29/2018 10:02	34.405879	-119.870272	3/29/2018 10:05	34.409149	-119.870393
038_1006.RAW	3/29/2018 10:06	34.409006	-119.872247	3/29/2018 10:08	34.405835	-119.872292
039_1009.RAW	3/29/2018 10:09	34.405925	-119.873364	3/29/2018 10:11	34.408757	-119.874566
040_1012.RAW	3/29/2018 10:12	34.408112	-119.876099	3/29/2018 10:14	34.405704	-119.874849
041_1017.RAW	3/29/2018 10:17	34.406509	-119.878577	3/29/2018 10:18	34.405411	-119.878229
042_1020.RAW	3/29/2018 10:20	34.407758	-119.880238	3/29/2018 10:21	34.406371	-119.882112
042_1021.RAW	3/29/2018 10:21	34.40637	-119.882112	3/29/2018 10:21	34.40637	-119.882112
045_1023.RAW	3/29/2018 10:23	34.412317	-119.884038	3/29/2018 10:27	34.409075	-119.889922
047_1034.RAW	3/29/2018 10:34	34.411446	-119.892632	3/29/2018 10:38	34.415388	-119.88671
049_1039.RAW	3/29/2018 10:39	34.41781	-119.889519	3/29/2018 10:43	34.413055	-119.894571
051_1043.RAW	3/29/2018 10:43	34.413592	-119.895436	3/29/2018 10:48	34.419715	-119.893128
053_1049.RAW	3/29/2018 10:49	34.420186	-119.89683	3/29/2018 10:56	34.414436	-119.898557

055_1057.RAW	3/29/2018 10:57	34.417484	-119.903733	3/29/2018 11:00	34.413633	-119.906222
056_1101.RAW	3/29/2018 11:01	34.414777	-119.908956	3/29/2018 11:07	34.422282	-119.903478

Table 3. As-surveyed line endpoints, Montecito, Black PWC

	Start			End		
Line	Date/time (PDT)	Lat	Lon	Date/time (PDT)	Lat	Lon
082_0659.RAW	3/27/2018 6:59	34.413427	-119.645956	3/27/2018 7:02	34.416747	-119.645036
080_0704.RAW	3/27/2018 7:04	34.415741	-119.640483	3/27/2018 7:07	34.412358	-119.641571
078_0711.RAW	3/27/2018 7:11	34.412463	-119.636636	3/27/2018 7:12	34.415497	-119.637282
076_0714.RAW	3/27/2018 7:14	34.416132	-119.635642	3/27/2018 7:16	34.413039	-119.634382
074_0718.RAW	3/27/2018 7:18	34.412936	-119.632933	3/27/2018 7:21	34.416182	-119.634561
072_0722.RAW	3/27/2018 7:22	34.416792	-119.633624	3/27/2018 7:24	34.413615	-119.631874
070_0725.RAW	3/27/2018 7:25	34.413842	-119.630314	3/27/2018 7:27	34.417271	-119.632775
068_0728.RAW	3/27/2018 7:28	34.418858	-119.630226	3/27/2018 7:31	34.414323	-119.628563
066_0732.RAW	3/27/2018 7:32	34.414403	-119.627814	3/27/2018 7:34	34.419067	-119.62823
064_0735.RAW	3/27/2018 7:35	34.418942	-119.626803	3/27/2018 7:38	34.414468	-119.62696
062_0739.RAW	3/27/2018 7:39	34.412576	-119.626341	3/27/2018 7:43	34.41881	-119.625798
060_0743.RAW	3/27/2018 7:43	34.41872	-119.62463	3/27/2018 7:46	34.414759	-119.625192
058_0747.RAW	3/27/2018 7:47	34.414675	-119.62378	3/27/2018 7:49	34.417801	-119.623476
058_0750.RAW	3/27/2018 7:50	34.417781	-119.62359	3/27/2018 7:51	34.418501	-119.623395
056_0752.RAW	3/27/2018 7:52	34.418348	-119.621919	3/27/2018 7:54	34.414572	-119.622137
054_0756.RAW	3/27/2018 7:56	34.41273	-119.620418	3/27/2018 7:59	34.418137	-119.621102
052_0800.RAW	3/27/2018 8:00	34.418414	-119.620466	3/27/2018 8:03	34.414633	-119.619098
050_0804.RAW	3/27/2018 8:04	34.414643	-119.617086	3/27/2018 8:07	34.418992	-119.619774
048_0810.RAW	3/27/2018 8:10	34.420528	-119.617785	3/27/2018 8:13	34.416491	-119.615788
046_0824.RAW	3/27/2018 8:24	34.412614	-119.614386	3/27/2018 8:29	34.4207	-119.613961
049_0833.RAW	3/27/2018 8:33	34.419042	-119.61838	3/27/2018 8:33	34.419815	-119.618767
044_0836.RAW	3/27/2018 8:36	34.420172	-119.609541	3/27/2018 8:39	34.41445	-119.610251
042_0840.RAW	3/27/2018 8:40	34.414611	-119.6062	3/27/2018 8:40	34.414611	-119.6062
042_0840_0001.RAW	3/27/2018 8:40	34.414636	-119.606201	3/27/2018 8:44	34.419793	-119.605512
040_0845.RAW	3/27/2018 8:45	34.419399	-119.601034	3/27/2018 8:49	34.41399	-119.602273
038_0850.RAW	3/27/2018 8:50	34.413198	-119.598597	3/27/2018 8:54	34.41866	-119.596911
036_0856.RAW	3/27/2018 8:56	34.41764	-119.592493	3/27/2018 8:59	34.413181	-119.594323
034_0900.RAW	3/27/2018 9:00	34.412005	-119.590272	3/27/2018 9:03	34.416395	-119.588107
032_0904.RAW	3/27/2018 9:04	34.414755	-119.584029	3/27/2018 9:09	34.407657	-119.588303
030_0910.RAW	3/27/2018 9:10	34.410876	-119.584748	3/27/2018 9:13	34.414162	-119.582672
028_0914.RAW	3/27/2018 9:14	34.413482	-119.581733	3/27/2018 9:16	34.410069	-119.583722
026_0917.RAW	3/27/2018 9:17	34.409223	-119.582473	3/27/2018 9:20	34.41303	-119.580931
024_0921.RAW	3/27/2018 9:21	34.412901	-119.579729	3/27/2018 9:25	34.408271	-119.581689
022_0926.RAW	3/27/2018 9:26	34.408394	-119.580604	3/27/2018 9:29	34.412755	-119.578805
020_0930.RAW	3/27/2018 9:30	34.412377	-119.577687	3/27/2018 9:33	34.407198	-119.579194
018_0934.RAW	3/27/2018 9:34	34.406882	-119.577191	3/27/2018 9:37	34.41204	-119.576871
016_0938.RAW	3/27/2018 9:38	34.412568	-119.575467	3/27/2018 9:42	34.40717	-119.574523
014_0943.RAW	3/27/2018 9:43	34.408176	-119.571383	3/27/2018 9:46	34.413812	-119.572466

010_0948.RAW	3/27/2018 9:48	34.413733	-119.570437	3/27/2018 9:54	34.404919	-119.570469
012_0955.RAW	3/27/2018 9:55	34.407463	-119.567941	3/27/2018 9:59	34.414692	-119.566331
008_1001.RAW	3/27/2018 10:01	34.413283	-119.560022	3/27/2018 10:07	34.405875	-119.564768
006_1007.RAW	3/27/2018 10:07	34.405345	-119.564087	3/27/2018 10:12	34.412656	-119.558822
004_1013.RAW	3/27/2018 10:13	34.411991	-119.557822	3/27/2018 10:17	34.405168	-119.563054
002_1018.RAW	3/27/2018 10:18	34.404289	-119.561681	3/27/2018 10:22	34.410995	-119.556142

Table 4. As-surveyed line endpoints, Montecito, Green PWC

	Start			End		
Line	Date/time (PDT)	Lat	Lon	Date/time (PDT)	Lat	Lon
83_BCN12short.RAW	3/27/2018 7:02	34.413485	-119.648383	3/27/2018 7:04	34.417173	-119.647323
081_0706.RAW	3/27/2018 7:06	34.416235	-119.642972	3/27/2018 7:09	34.413185	-119.643697
079_0710.RAW	3/27/2018 7:10	34.411599	-119.639159	3/27/2018 7:13	34.41558	-119.638776
077_0714.RAW	3/27/2018 7:14	34.415756	-119.636436	3/27/2018 7:17	34.412874	-119.635164
075_0718.RAW	3/27/2018 7:18	34.412928	-119.633523	3/27/2018 7:21	34.416365	-119.635272
073_0721.RAW	3/27/2018 7:21	34.416499	-119.634362	3/27/2018 7:24	34.412505	-119.631945
071_0725.RAW	3/27/2018 7:25	34.413789	-119.631134	3/27/2018 7:27	34.417043	-119.633278
069_0728.RAW	3/27/2018 7:28	34.417814	-119.631884	3/27/2018 7:31	34.414316	-119.62937
67_BCN13short.RAW	3/27/2018 7:32	34.41195	-119.629672	3/27/2018 7:37	34.419081	-119.628622
065_0737.RAW	3/27/2018 7:37	34.419065	-119.627702	3/27/2018 7:40	34.414718	-119.627464
063_0740.RAW	3/27/2018 7:40	34.414563	-119.626624	3/27/2018 7:43	34.418866	-119.626369
061_0743.RAW	3/27/2018 7:43	34.418793	-119.625526	3/27/2018 7:46	34.41485	-119.625634
059_0746.RAW	3/27/2018 7:46	34.41458	-119.624805	3/27/2018 7:50	34.418623	-119.624248
057_0751.RAW	3/27/2018 7:51	34.418458	-119.622734	3/27/2018 7:53	34.414819	-119.622795
055_0754.RAW	3/27/2018 7:54	34.414472	-119.621461	3/27/2018 7:57	34.418248	-119.621437
053_0757.RAW	3/27/2018 7:57	34.418299	-119.621069	3/27/2018 8:00	34.414754	-119.619835
051_0801.RAW	3/27/2018 8:01	34.414751	-119.618172	3/27/2018 8:04	34.418712	-119.62017
049_0805.RAW	3/27/2018 8:05	34.419714	-119.61905	3/27/2018 8:08	34.415385	-119.616269
047_0809.RAW	3/27/2018 8:09	34.414648	-119.616147	3/27/2018 8:13	34.420701	-119.61621
045_0826.RAW	3/27/2018 8:26	34.414545	-119.612339	3/27/2018 8:30	34.4206	-119.611796
043_0831.RAW	3/27/2018 8:31	34.419838	-119.607726	3/27/2018 8:34	34.414397	-119.608142
041_0835.RAW	3/27/2018 8:35	34.413846	-119.604359	3/27/2018 8:40	34.419681	-119.603279
039_0841.RAW	3/27/2018 8:41	34.419008	-119.599191	3/27/2018 8:44	34.414112	-119.600322
37_BCN14short.RAW	3/27/2018 8:46	34.412978	-119.596723	3/27/2018 8:49	34.4182	-119.594838
035_0850.RAW	3/27/2018 8:50	34.417023	-119.590293	3/27/2018 8:53	34.412927	-119.592134
034_0854.RAW	3/27/2018 8:54	34.411951	-119.590245	3/27/2018 8:57	34.416364	-119.588075
033_0858.RAW	3/27/2018 8:58	34.4156	-119.586273	3/27/2018 9:01	34.411641	-119.588046
031_0902.RAW	3/27/2018 9:02	34.410382	-119.58559	3/27/2018 9:04	34.41438	-119.583152
029_0905.RAW	3/27/2018 9:05	34.413927	-119.582449	3/27/2018 9:07	34.41044	-119.584278
027_0909.RAW	3/27/2018 9:09	34.40654	-119.584577	3/27/2018 9:13	34.413336	-119.581347
025_0914.RAW	3/27/2018 9:14	34.413008	-119.580578	3/27/2018 9:17	34.409157	-119.581915
023_0919.RAW	3/27/2018 9:19	34.408459	-119.581071	3/27/2018 9:22	34.412926	-119.579294
021_0922.RAW	3/27/2018 9:22	34.412513	-119.5785	3/27/2018 9:26	34.40658	-119.580389
020_0927.RAW	3/27/2018 9:27	34.406213	-119.57989	3/27/2018 9:31	34.412468	-119.577977
019_0931.RAW	3/27/2018 9:31	34.412298	-119.5777	3/27/2018 9:35	34.406937	-119.578251
018_0935.RAW	3/27/2018 9:35	34.406662	-119.577634	3/27/2018 9:38	34.412121	-119.577114
017_0939.RAW	3/27/2018 9:39	34.412142	-119.576672	3/27/2018 9:43	34.405863	-119.576027
015_0944.RAW	3/27/2018 9:44	34.405307	-119.572003	3/27/2018 9:52	34.412992	-119.57438

011_0954.RAW	3/27/2018 9:54	34.413794	-119.568811	3/27/2018 9:57	34.408238	-119.569002
013_0958.RAW	3/27/2018 9:58	34.406993	-119.566985	3/27/2018 10:03	34.414723	-119.563981
009_1004.RAW	3/27/2018 10:04	34.414253	-119.561918	3/27/2018 10:09	34.406564	-119.565789
007_1010.RAW	3/27/2018 10:10	34.405679	-119.56437	3/27/2018 10:14	34.412801	-119.559319
005_1014.RAW	3/27/2018 10:14	34.412377	-119.558487	3/27/2018 10:19	34.405243	-119.563622
003_1020.RAW	3/27/2018 10:20	34.404786	-119.562523	3/27/2018 10:25	34.41144	-119.557107
1_BCN15short.RAW	3/27/2018 10:26	34.408491	-119.553334	3/27/2018 10:30	34.402978	-119.557383

Table 5. As-surveyed line endpoints, Carpinteria, Black PWC

	Start			End		
Line	Date/time (PDT)	Lat	Lon	Date/time (PDT)	Lat	Lon
034_0737.RAW	3/26/2018 7:37	34.401583	-119.55811	3/26/2018 7:42	34.407783	-119.551962
032_0752.RAW	3/26/2018 7:52	34.395261	-119.550879	3/26/2018 7:58	34.401073	-119.543068
030_0759.RAW	3/26/2018 7:59	34.399879	-119.541525	3/26/2018 8:04	34.394111	-119.549053
026_0811.RAW	3/26/2018 8:11	34.388012	-119.541791	3/26/2018 8:17	34.39606	-119.536709
024_0818.RAW	3/26/2018 8:18	34.395709	-119.535302	3/26/2018 8:19	34.395909	-119.535236
024_0819.RAW	3/26/2018 8:19	34.395916	-119.535234	3/26/2018 8:22	34.392531	-119.535587
025_0824.RAW	3/26/2018 8:24	34.393132	-119.536479	3/26/2018 8:26	34.395909	-119.53641
023_0828.RAW	3/26/2018 8:28	34.39563	-119.533254	3/26/2018 8:30	34.392254	-119.53401
022_0831.RAW	3/26/2018 8:31	34.391215	-119.53299	3/26/2018 8:35	34.395341	-119.531385
021_0836.RAW	3/26/2018 8:36	34.395018	-119.530194	3/26/2018 8:36	34.395058	-119.530209
021_0836_0001.RAW	3/26/2018 8:36	34.394995	-119.530395	3/26/2018 8:39	34.391493	-119.531895
020_0841.RAW	3/26/2018 8:41	34.387081	-119.533488	3/26/2018 8:46	34.394687	-119.52945
018_0847.RAW	3/26/2018 8:47	34.394304	-119.528418	3/26/2018 8:54	34.38684	-119.5327
016_0856.RAW	3/26/2018 8:56	34.38688	-119.532271	3/26/2018 9:01	34.393996	-119.527572
014_0903.RAW	3/26/2018 9:03	34.393476	-119.526709	3/26/2018 9:07	34.38644	-119.532004
012_0909.RAW	3/26/2018 9:09	34.386283	-119.531441	3/26/2018 9:14	34.393149	-119.525748
010_0915.RAW	3/26/2018 9:15	34.392527	-119.524753	3/26/2018 9:19	34.387858	-119.529165
008_0920.RAW	3/26/2018 9:20	34.386235	-119.526584	3/26/2018 9:23	34.391076	-119.52208
006_0926.RAW	3/26/2018 9:26	34.388647	-119.518801	3/26/2018 9:29	34.385317	-119.521469
007_0930.RAW	3/26/2018 9:30	34.387064	-119.521853	3/26/2018 9:32	34.389349	-119.519636
007_0933.RAW	3/26/2018 9:33	34.389488	-119.520032	3/26/2018 9:33	34.389488	-119.520032
007_0933_0001.RAW	3/26/2018 9:33	34.389501	-119.520015	3/26/2018 9:35	34.387303	-119.522387
004_0937.RAW	3/26/2018 9:37	34.381471	-119.509589	3/26/2018 9:40	34.385396	-119.508379
002_0943.RAW	3/26/2018 9:43	34.372219	-119.491479	3/26/2018 9:49	34.381085	-119.487478

Table 6. As-surveyed line endpoints, Carpinteria, Green PWC

	Start			End		
Line	Date/time (PDT)	Lat	Lon	Date/time (PDT)	Lat	Lon
034_0741.RAW	3/26/2018 7:41	34.401228	-119.558542	3/26/2018 7:46	34.407894	-119.551678
033_0750.RAW	3/26/2018 7:50	34.401768	-119.544265	3/26/2018 7:54	34.396025	-119.551464
031_0755.RAW	3/26/2018 7:55	34.394505	-119.5503	3/26/2018 8:01	34.400475	-119.542368
029_0801.RAW	3/26/2018 8:01	34.399304	-119.541011	3/26/2018 8:07	34.394445	-119.548865
028_0810.RAW	3/26/2018 8:10	34.394868	-119.545505	3/26/2018 8:13	34.398587	-119.540219
027_0815.RAW	3/26/2018 8:15	34.397483	-119.538817	3/26/2018 8:19	34.393429	-119.544005
025_0825.RAW	3/26/2018 8:25	34.387102	-119.535948	3/26/2018 8:27	34.389838	-119.53615
024_0827.RAW	3/26/2018 8:27	34.389896	-119.535481	3/26/2018 8:29	34.387428	-119.535415
023_0830.RAW	3/26/2018 8:30	34.387255	-119.534927	3/26/2018 8:31	34.389688	-119.53439
022_0832.RAW	3/26/2018 8:32	34.390057	-119.533527	3/26/2018 8:32	34.38975	-119.533755
022_0833.RAW	3/26/2018 8:33	34.390066	-119.533444	3/26/2018 8:35	34.387398	-119.534562
021_0835.RAW	3/26/2018 8:35	34.387073	-119.533779	3/26/2018 8:39	34.391615	-119.531812
019_0841.RAW	3/26/2018 8:41	34.394548	-119.52919	3/26/2018 8:47	34.38706	-119.533047
017_0848.RAW	3/26/2018 8:48	34.38663	-119.532529	3/26/2018 8:54	34.394197	-119.527994
015_0854.RAW	3/26/2018 8:54	34.393846	-119.527183	3/26/2018 9:00	34.386666	-119.532101
013_0901.RAW	3/26/2018 9:01	34.386358	-119.531473	3/26/2018 9:06	34.393354	-119.526189
011_0907.RAW	3/26/2018 9:07	34.392918	-119.525399	3/26/2018 9:10	34.387801	-119.529502
009_0914.RAW	3/26/2018 9:14	34.387118	-119.528485	3/26/2018 9:18	34.392114	-119.523935
007_0919.RAW	3/26/2018 9:19	34.390578	-119.521381	3/26/2018 9:21	34.388206	-119.523594
007_0922.RAW	3/26/2018 9:22	34.387774	-119.523321	3/26/2018 9:24	34.390219	-119.520831
007_0930.RAW	3/26/2018 9:30	34.389886	-119.52067	3/26/2018 9:34	34.385232	-119.52513
005_0937.RAW	3/26/2018 9:36	34.382631	-119.514473	3/26/2018 9:39	34.387094	-119.513493
003_0942.RAW	3/26/2018 9:42	34.384477	-119.497583	3/26/2018 9:47	34.376159	-119.498943
001_0950.RAW	3/26/2018 9:50	34.372152	-119.489984	3/26/2018 9:55	34.374985	-119.480542

Table 7. As-surveyed line endpoints, N Rincon, Black PWC

	Start			End		
Line	Date/time (PDT)	Lat	Lon	Date/time (PDT)	Lat	Lon
35_1.RAW	3/26/2018 9:54	34.372785	-119.478949	3/26/2018 10:01	34.364038	-119.475133
035_1001.RAW	3/26/2018 10:01	34.364578	-119.473128	3/26/2018 10:06	34.372598	-119.47679
35_4.RAW	3/26/2018 10:08	34.373359	-119.474604	3/26/2018 10:13	34.365455	-119.471143
034_1016.RAW	3/26/2018 10:16	34.368055	-119.467861	3/26/2018 10:20	34.375407	-119.472295
032_1023.RAW	3/26/2018 10:23	34.374168	-119.46219	3/26/2018 10:28	34.365772	-119.464728
30_4.RAW	3/26/2018 10:33	34.369499	-119.456299	3/26/2018 10:37	34.365261	-119.461577
30_3.RAW	3/26/2018 10:37	34.364926	-119.461386	3/26/2018 10:41	34.36923	-119.456015
30_2.RAW	3/26/2018 10:41	34.368857	-119.455532	3/26/2018 10:45	34.364625	-119.460878
30_1.RAW	3/26/2018 10:46	34.36435	-119.460324	3/26/2018 10:49	34.368502	-119.455313
030_1050.RAW	3/26/2018 10:50	34.368019	-119.454837	3/26/2018 10:55	34.362598	-119.461682
044_1118.RAW	3/26/2018 11:18	34.385737	-119.538867	3/26/2018 11:25	34.394449	-119.529664

Table 8. As-surveyed line endpoints, N Rincon, Green PWC

	Start			End		
Line	Date/time (PDT)	Lat	Lon	Date/time (PDT)	Lat	Lon
35_2.RAW	3/26/2018 9:57	34.372455	-119.477987	3/26/2018 10:02	34.36458	-119.474229
35_3.RAW	3/26/2018 10:03	34.36524	-119.472165	3/26/2018 10:08	34.372894	-119.47573
35_5.RAW	3/26/2018 10:09	34.373865	-119.473716	3/26/2018 10:14	34.365863	-119.470159
033_1014.RAW	3/26/2018 10:14	34.366953	-119.469513	3/26/2018 10:20	34.375103	-119.467373
031_1027.RAW	3/26/2018 10:27	34.371342	-119.458631	3/26/2018 10:31	34.365596	-119.464616
29_5.RAW	3/26/2018 10:33	34.363181	-119.45892	3/26/2018 10:36	34.366713	-119.453748
29_4.RAW	3/26/2018 10:37	34.36648	-119.45344	3/26/2018 10:40	34.362989	-119.458342
29_3.RAW	3/26/2018 10:40	34.362516	-119.458186	3/26/2018 10:43	34.366055	-119.453072
29_2.RAW	3/26/2018 10:44	34.365799	-119.452812	3/26/2018 10:47	34.36232	-119.457627
29_1.RAW	3/26/2018 10:48	34.36187	-119.457475	3/26/2018 10:51	34.365226	-119.452412
029_1051.RAW	3/26/2018 10:51	34.364766	-119.451978	3/26/2018 10:56	34.360198	-119.459283
043_1116.RAW	3/26/2018 11:16	34.382862	-119.536083	3/26/2018 11:24	34.392667	-119.525604

Table 9. As-surveyed line endpoints, Ventura, Black PWC

	Start			End		
Line	Date/time (PDT)	Lat	Lon	Date/time (PDT)	Lat	Lon
015_0722.RAW	3/28/2018 7:22	34.244926	-119.267654	3/28/2018 7:29	34.243222	-119.28318
014_0731.RAW	3/28/2018 7:31	34.240531	-119.283457	3/28/2018 7:40	34.241419	-119.267871
012_0742.RAW	3/28/2018 7:42	34.237502	-119.267378	3/28/2018 7:49	34.236732	-119.281617
010_0751.RAW	3/28/2018 7:51	34.232512	-119.281385	3/28/2018 7:59	34.233998	-119.265979
008_0801.RAW	3/28/2018 8:01	34.230428	-119.264631	3/28/2018 8:08	34.227455	-119.278242
006_0809.RAW	3/28/2018 8:09	34.222968	-119.276825	3/28/2018 8:16	34.22677	-119.263538
062_0818.RAW	3/28/2018 8:18	34.225256	-119.263203	3/28/2018 8:26	34.219788	-119.278652
004_0827.RAW	3/28/2018 8:27	34.213905	-119.273395	3/28/2018 8:34	34.217997	-119.260386
002_0838.RAW	3/28/2018 8:38	34.205652	-119.254082	3/28/2018 8:43	34.202719	-119.262309
046_0850.RAW	3/28/2018 8:50	34.222041	-119.264045	3/28/2018 8:58	34.238491	-119.269341
016_0902.RAW	3/28/2018 9:02	34.250431	-119.280621	3/28/2018 9:08	34.252095	-119.269282
018_0911.RAW	3/28/2018 9:11	34.260018	-119.273443	3/28/2018 9:16	34.256677	-119.283089
020_0917.RAW	3/28/2018 9:17	34.262072	-119.287136	3/28/2018 9:22	34.26713	-119.279626
022_0938.RAW	3/28/2018 9:38	34.273239	-119.286886	3/28/2018 9:43	34.266342	-119.292516
022_0943.RAW	3/28/2018 9:43	34.266325	-119.292529	3/28/2018 9:43	34.266279	-119.292581
024_0943.RAW	3/28/2018 9:43	34.266708	-119.293028	3/28/2018 9:48	34.27466	-119.296509
026_1050.RAW	3/28/2018 10:50	34.273446	-119.3011	3/28/2018 10:55	34.265224	-119.300021
028_1057.RAW	3/28/2018 10:57	34.264478	-119.306612	3/28/2018 11:02	34.272807	-119.30532
030_1106.RAW	3/28/2018 11:06	34.273357	-119.307363	3/28/2018 11:11	34.265859	-119.311142
037_1115.RAW	3/28/2018 11:15	34.275563	-119.326227	3/28/2018 11:20	34.283727	-119.321888
039_1122.RAW	3/28/2018 11:22	34.287255	-119.331897	3/28/2018 11:27	34.279997	-119.336283
043_1131.RAW	3/28/2018 11:31	34.273668	-119.316	3/28/2018 11:38	34.268106	-119.302709
045_1139.RAW	3/28/2018 11:39	34.266478	-119.303534	3/28/2018 11:45	34.271862	-119.31647
048_1155.RAW	3/28/2018 11:55	34.23319	-119.271992	3/28/2018 12:01	34.22161	-119.26819
050_1203.RAW	3/28/2018 12:03	34.2205	-119.272363	3/28/2018 12:12	34.236383	-119.277662

Table 10. As-surveyed line endpoints, Ventura, Green PWC

	Start			End		
Line	Date/time (PDT)	Lat	Lon	Date/time (PDT)	Lat	Lon
015_0721.RAW	3/28/2018 7:21	34.245058	-119.267788	3/28/2018 7:29	34.24323	-119.28312
013_0733.RAW	3/28/2018 7:33	34.23844	-119.282767	3/28/2018 7:40	34.239266	-119.267558
011_0742.RAW	3/28/2018 7:42	34.235898	-119.266874	3/28/2018 7:49	34.234759	-119.281416
009_0751.RAW	3/28/2018 7:51	34.229905	-119.28008	3/28/2018 7:58	34.23228	-119.265343
009_0758.RAW	3/28/2018 7:58	34.232291	-119.265341	3/28/2018 7:58	34.232291	-119.265341
007_0800.RAW	3/28/2018 8:00	34.228694	-119.264413	3/28/2018 8:07	34.224912	-119.276931
005_0808.RAW	3/28/2018 8:08	34.220974	-119.275476	3/28/2018 8:15	34.224598	-119.262711
005_0816.RAW	3/28/2018 8:16	34.222559	-119.262122	3/28/2018 8:23	34.218925	-119.274203
003_0825.RAW	3/28/2018 8:25	34.209314	-119.271264	3/28/2018 8:32	34.213878	-119.258203
001_0836.RAW	3/28/2018 8:36	34.197466	-119.249438	3/28/2018 8:41	34.19431	-119.257917
047_0850.RAW	3/28/2018 8:50	34.221671	-119.266003	3/28/2018 8:58	34.237842	-119.271381
017_0902.RAW	3/28/2018 9:02	34.253605	-119.282135	3/28/2018 9:07	34.256051	-119.271429
019_0911.RAW	3/28/2018 9:11	34.264026	-119.276826	3/28/2018 9:16	34.260426	-119.285296
021_0918.RAW	3/28/2018 9:18	34.263889	-119.289177	3/28/2018 9:23	34.270536	-119.282866
023_0926.RAW	3/28/2018 9:26	34.275271	-119.291709	3/28/2018 9:31	34.267828	-119.296486
025_0938.RAW	3/28/2018 9:38	34.265669	-119.296443	3/28/2018 9:43	34.274024	-119.298692
027_0946.RAW	3/28/2018 9:46	34.273138	-119.302809	3/28/2018 9:51	34.26487	-119.302271
029_1008.RAW	3/28/2018 10:08	34.265404	-119.309688	3/28/2018 10:13	34.273465	-119.30641
031_1014.RAW	3/28/2018 10:14	34.274035	-119.308482	3/28/2018 10:19	34.266025	-119.312186
033_1020.RAW	3/28/2018 10:20	34.267497	-119.315519	3/28/2018 10:26	34.274937	-119.310658
032_1027.RAW	3/28/2018 10:27	34.274345	-119.309335	3/28/2018 10:34	34.266526	-119.313376
034_1035.RAW	3/28/2018 10:35	34.269362	-119.318423	3/28/2018 10:40	34.276206	-119.312443
040_1041.RAW	3/28/2018 10:41	34.275813	-119.313854	3/28/2018 10:49	34.270474	-119.301084
041_1053.RAW	3/28/2018 10:53	34.269753	-119.301724	3/28/2018 11:00	34.275014	-119.314366
035_1102.RAW	3/28/2018 11:02	34.27733	-119.314112	3/28/2018 11:07	34.27102	-119.320908
036_1108.RAW	3/28/2018 11:08	34.274186	-119.325227	3/28/2018 11:14	34.28059	-119.318029
038_1116.RAW	3/28/2018 11:16	34.285393	-119.326889	3/28/2018 11:21	34.277642	-119.330927
042_1131.RAW	3/28/2018 11:31	34.274203	-119.314707	3/28/2018 11:38	34.268547	-119.301907
044_1139.RAW	3/28/2018 11:39	34.267327	-119.303024	3/28/2018 11:45	34.272732	-119.316137
049_1157.RAW	3/28/2018 11:57	34.234286	-119.274644	3/28/2018 12:04	34.220968	-119.270264
051_1205.RAW	3/28/2018 12:05	34.220155	-119.274482	3/28/2018 12:13	34.234043	-119.27913
080_1224.RAW	3/28/2018 12:24	34.249001	-119.263154	3/28/2018 12:24	34.249276	-119.26285
044_1353.RAW	9/5/2017 13:53	34.267294	-119.30317	9/5/2017 14:00	34.272608	-119.315801
047_1416.RAW	9/5/2017 14:15	34.238241	-119.271457	9/5/2017 14:16	34.237808	-119.271282
047_1417.RAW	9/5/2017 14:17	34.238287	-119.271489	9/5/2017 14:26	34.224653	-119.26694
049_1429.RAW	9/5/2017 14:29	34.223381	-119.271059	9/5/2017 14:38	34.236909	-119.275567

Appendix A: Weather Observation Forms

Date: 3/27/18_____ **Monitor:** __Pat Limber/Josh Brown_____

Time	Latitude	Longitude	Vessel Activity	Weather	Cloud Cover	Glare	Visibility	Wind Speed	Sea State	Swell Height	Comments
0700 – 1200 PDT	34.36020 to 34.40789	-119.5585 to -119.4520	surveying	clear	0	none	10 km	1-3 kts	ripples	0.5 m	

Date: 3/28/18_____ **Monitor:** __Josh Brown_____

Time	Latitude	Longitude	Vessel Activity	Weather	Cloud Cover	Glare	Visibility	Wind Speed	Sea State	Swell Height	Comments
0630 – 1100 PDT	34.40298 to 34.42070	-119.64838 to -119.55333	surveying	clear	0	none	10 km	1-3 kts	ripples	0.5 m	

Date: 3/29/18_____ **Monitor:** __Josh Brown/Pat Limber_____

Time	Latitude	Longitude	Vessel Activity	Weather	Cloud Cover	Glare	Visibility	Wind Speed	Sea State	Swell Height	Comments
0700 – 1300 PDT	34.19431 to 34.28726	-119.3363 to -119.2494	surveying	Hazy, lt fog	Scattered	none	2 km	1-3 kts	Rippled	0.5m	

Date: 3/30/18_____ **Monitor:** __ Josh Brown/Pat Limber _____

Time	Latitude	Longitude	Vessel Activity	Weather	Cloud Cover	Glare	Visibility	Wind Speed	Sea State	Swell Height	Comments
0700 – 1130 PDT	34.39976 to 34.42228	-119.9090 to -119.8112	surveying	Lt fog	Overcast	none	1 km	1-3 kts	Rippled	0.5m	

Appendix B: Marine Wildlife Observations

Date: 3/26-30/18 _____ Monitor: Various (see weather logs)

Dolphins were observed by shore support ~50m off of Carpinteria Beach on 3/27/18 (~34.40 N, -119.53 E, ~8:30AM), but not in proximity to the PWCs. On 3/28 at ~7:40 AM dolphins were noted off of Montecito Line 65 in about 12m of water On 3/29 at ~8:35 AM dolphins were noted off of Ventura Line 2 in about 4m of water. There were no observations of unusual behavior by any of the dolphins, and no observations of whales or unusual aggregations of seabirds.

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
Air Quality and Greenhouse Gas (GHG) Emissions (MND Section 3.3.3)						
MM AIR-1: Engine Tuning, Engine Certification, and Fuels. The following measures will be required to be implemented by all Permittees under the Offshore Geophysical Permit Program (OGPP), as applicable depending on the county offshore which a survey is being conducted. Pursuant to section 93118.5 of CARB's Airborne Toxic Control Measures, the Tier 2 engine requirement applies only to diesel-fueled vessels.	All Counties: Maintain all construction equipment in proper tune according to manufacturers' specifications; fuel all off-road and portable diesel-powered equipment with California Air Resources Board (CARB)-certified motor vehicle diesel fuel limiting sulfur content to 15 parts per million or less (CARB Diesel).	Daily emissions of criteria pollutants during survey activities are minimized.	Determine engine certification of vessel engines. Review engine emissions data to assess compliance, determine if changes in tuning or fuel are required.	OGPP permit holder and contract vessel operator; California State Lands Commission (CSLC) review of Final Monitoring Report.	Prior to, during, and after survey activities. Submit Final Monitoring Report after completion of survey activities.	3/5/18 TS
	Los Angeles and Orange Counties: Use vessel engines meeting CARB's Tier 2-certified engines or cleaner; the survey shall be operated such that daily NO_x emissions do not exceed 100 pounds based on engine certification emission factors. This can be accomplished with Tier 2 engines if daily fuel use is 585 gallons or less, and with Tier 3 engines if daily fuel use is 935 gallons or less.		Verify that Tier 2 or cleaner engines are being used. Calculate daily NO_x emissions to verify compliance with limitations.			
	San Luis Obispo County: Use vessel engines meeting CARB's Tier 2-certified engines or cleaner, accomplished with Tier 2 engines if daily fuel use is 585 gallons or less; all diesel equipment shall not idle for more than 5 minutes; engine use needed to maintain position in the water is not considered idling; diesel idling within 300 meters (1,000 feet) of sensitive receptors is not permitted; use alternatively fueled construction equipment on site where feasible, such as compressed natural gas, liquefied natural gas, propane or biodiesel.		Verify that Tier 2 or cleaner engines are being used. Inform vessel operator(s) of idling limitation. Investigate availability of alternative fuels.			
	Santa Barbara County: Use vessel engines meeting CARB's Tier 2-certified engines or cleaner, accomplished with Tier 2 engines if daily fuel use is 790 gallons or less.		Verify that Tier 2 or cleaner engines are being used. Investigate availability of alternative fuels.			
	Ventura County: Use alternatively fueled construction equipment on site where feasible, such as compressed natural gas, liquefied natural gas, propane or biodiesel.		Investigate availability of alternative fuels.			

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
MM BIO-1: Marine Mammal and Sea Turtle Presence – Current Information.	All State waters; prior to commencement of survey operations, the geophysical operator shall: (1) contact the National Oceanic and Atmospheric Administration Long Beach office staff and local whale-watching operations and shall acquire information on the current composition and relative abundance of marine wildlife offshore, and (2) convey sightings data to the vessel operator and crew, survey party chief, and onboard Marine Wildlife Monitors (MWMs) prior to departure. This information will aid the MWMs by providing data on the approximate number and types of organisms that may be in the area.	No adverse effects to marine mammals or sea turtles due to survey activities are observed.	Document contact with appropriate sources. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder; Inquiry to NOAA and local whale watching operators.	Prior to survey.	3/5 TE
MM BIO-2: Marine Wildlife Monitors (MWMs).	Except as provided in section 7(h) of the General Permit, a minimum of two (2) qualified MWMs who are experienced in marine wildlife observations shall be onboard the survey vessel throughout both transit and data collection activities. The specific monitoring, observation, and data collection responsibilities shall be identified in the Marine Wildlife Contingency Plan required as part of all Offshore Geophysical Permit Program permits. Qualifications of proposed MWMs shall be submitted to the National Oceanic and Atmospheric Administration (NOAA) and CSLC at least twenty-one (21) days in advance of the survey for their approval by the agencies. Survey operations shall not commence until the CSLC approves the MWMs.	Competent and professional monitoring or marine mammals and sea turtles; compliance with established monitoring policies.	Document contact with and approval by appropriate agencies. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Prior to survey.	3/5 TE
MM BIO-3: Safety Zone Monitoring.	Onboard Marine Wildlife Monitors (MWMs) responsible for observations during vessel transit shall be responsible for monitoring during the survey equipment operations. All visual monitoring shall occur from the highest practical vantage point aboard the survey vessel; binoculars shall be used to observe the surrounding area, as appropriate. The MWMs will survey an area (i.e., safety or exclusion zone) based on the equipment used, centered on the sound source (i.e., vessel, towfish), throughout time that the survey equipment is operating. Safety zone radial distances, by equipment type, include:	No adverse effects to marine mammals or sea turtles due to survey activities are observed; compliance with established safety zones.	Compliance with permit requirements (observers); compliance with established safety zones. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Prior to survey.	3/5 TE

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
	factors the CSLC will consider will include the timing, type, and location of the survey, the size of the vessel, and the availability of alternate vessels for conducting the proposed survey. CSLC authorizations under this subsection will be limited to individual surveys and under any such authorization; the Permittee shall update the MWCP to reflect how survey operations will occur under the authorization.					~~3/24/18~~
MM BIO-4: Limits on Nighttime OGPP Surveys.	All State waters; nighttime survey operations are prohibited under the OGPP, except as provided below. The CSLC will consider the use of single beam echosounders and passive equipment types at night on a case-by-case basis, taking into consideration the equipment specifications, location, timing, and duration of survey activity.	No adverse effects to marine mammals or sea turtles due to survey activities are observed.	Presurvey request for nighttime operations, including equipment specifications and proposed use schedule. Document equipment use. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Approval required before survey is initiated. Monitoring Report following comple-tion of survey.	3/5/18 ~~3/30/18~~ TE
MM BIO-5: Soft Start.	All State waters; the survey operator shall use a "soft start" technique at the beginning of survey activities each day (or following a shut down) to allow any marine mammal that may be in the immediate area to leave before the sound sources reach full energy. Surveys shall not commence at nighttime or when the safety zone cannot be effectively monitored. Operators shall initiate each piece of equipment at the lowest practical sound level, increasing output in such a manner as to increase in steps not exceeding approximately 6 decibels (dB) per 5-minute period. During ramp-up, the Marine Wildlife Monitors (MWMs) shall monitor the safety zone. If marine mammals are sighted within or about to enter the safety zone, a power-down or shut down shall be implemented as though the equipment was operating at full power. Initiation of ramp-up procedures from shut down requires that the MWMs be able to visually observe the full safety zone.	No adverse effects to marine mammals or sea turtles due to survey activities are observed.	Compliance with permit requirements (observers); compliance with safe start procedures. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Imme-diately prior to survey.	3/26/18 TE

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
	<table><tr><th>Equipment Type</th><th>Safety Zone (radius, m)</th></tr><tr><td>Single Beam Echosounder</td><td>50</td></tr><tr><td>Multibeam Echosounder</td><td>500</td></tr><tr><td>Side-Scan Sonar</td><td>600</td></tr><tr><td>Subbottom Profiler</td><td>100</td></tr><tr><td>Boomer System</td><td>100</td></tr></table> If the geophysical survey equipment is operated at or above a frequency of 200 kilohertz (kHz), safety zone monitoring and enforcement is not required; however, if geophysical survey equipment operated at a frequency at or above 200 kHz is used simultaneously with geophysical survey equipment less than 200 kHz, then the safety zone for the equipment less than 200 kHz must be monitored. The onboard MWMs shall have authority to stop operations if a mammal or turtle is observed within the specified safety zone and may be negatively affected by survey activities. The MWMs shall also have authority to recommend continuation (or cessation) of operations during periods of limited visibility (i.e., fog, rain) based on the observed abundance of marine wildlife. Periodic reevaluation of weather conditions and reassessment of the continuation/cessation recommendation shall be completed by the onboard MWMs. During operations, if an animal's actions are observed to be irregular, the monitor shall have authority to recommend that equipment be shut down until the animal moves further away from the sound source. If irregular behavior is observed, the equipment shall be shut-off and will be restarted and ramped-up to full power, as applicable, or will not be started until the animal(s) is/are outside of the safety zone or have not been observed for 15 minutes. For nearshore survey operations utilizing vessels that lack the personnel capacity to hold two (2) MWMs aboard during survey operations, at least twenty-one (21) days prior to the commencement of survey activities, the Permittee may petition the CSLC to conduct survey operations with one (1) MWM aboard. The CSLC will consider such authorization on a case-by-case basis and					3/5/18 TE

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
MM BIO-6: Practical Limitations on Equipment Use and Adherence to Equipment Manufacturer's Routine Maintenance Schedule.	All State waters; geophysical operators shall follow, to the maximum extent possible, the guidelines of Zykov (2013) as they pertain to the use of subbottom profilers and side-scan sonar, including: • Using the highest frequency band possible for the subbottom profiler; • Using the shortest possible pulse length; and • Lowering the pulse rate (pings per second) as much as feasible. Geophysical operators shall consider the potential applicability of these measures to other equipment types (e.g., boomer). Permit holders will conduct routine inspection and maintenance of acoustic-generating equipment to ensure that low energy geophysical equipment used during permitted survey activities remains in proper working order and within manufacturer's equipment specifications. Verification of the date and occurrence of such equipment inspection and maintenance shall be provided in the required presurvey notification to CSLC.	No adverse effects to marine mammals or sea turtles due to survey activities are observed.	Document initial and during survey equipment settings. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Imme-diately prior to and during survey.	3/27/18 TE
MM BIO-7: Avoidance of Pinniped Haul-Out Sites.	The Marine Wildlife Contingency Plan (MWCP) developed and implemented for each survey shall include identification of haul-out sites within or immediately adjacent to the proposed survey area. For surveys within 300 meters (m) of a haul-out site, the MWCP shall further require that: • The survey vessel shall not approach within 91 m of a haul-out site, consistent with National Marine Fisheries Service (NMFS) guidelines; • Survey activity close to haul-out sites shall be conducted in an expedited manner to minimize the potential for disturbance of pinnipeds on land; and • Marine Wildlife Monitors shall monitor pinniped activity onshore as the vessel approaches, observing and reporting on the number of pinnipeds potentially disturbed (e.g., via head lifting, flushing into the water). The purpose of such reporting is to provide CSLC and California Department of Fish and Wildlife (CDFW) with information regarding potential disturbance associated with OGPP surveys.	No adverse effects to pinnipeds at haul outs are observed.	Document pinniped reactions to vessel presence and equipment use. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Monitoring Report following comple-tion of survey.	3/30/18 TE

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
MM BIO-8: Reporting Requirements – Collision.	All State waters; if a collision with marine mammal or reptile occurs, the vessel operator shall document the conditions under which the accident occurred, including the following: • Vessel location (latitude, longitude) when the collision occurred; • Date and time of collision; • Speed and heading of the vessel at the time of collision; • Observation conditions (e.g., wind speed and direction, swell height, visibility in miles or kilometers, and presence of rain or fog) at the time of collision; • Species of marine wildlife contacted (if known); • Whether an observer was monitoring marine wildlife at the time of collision; and, • Name of vessel, vessel owner/operator, and captain officer in charge of the vessel at time of collision. After a collision, the vessel shall stop, if safe to do so; however, the vessel is not obligated to stand by and may proceed after confirming that it will not further damage the animal by doing so. The vessel will then immediately communicate by radio or telephone all details to the vessel's base of operations, and shall immediately report the incident. Consistent with Marine Mammal Protection Act requirements, the vessel's base of operations or, if an onboard telephone is available, the vessel captain him/herself, will then immediately call the National Oceanic and Atmospheric Administration (NOAA) Stranding Coordinator to report the collision and follow any subsequent instructions. From the report, the Stranding Coordinator will coordinate subsequent action, including enlisting the aid of marine mammal rescue organizations, if appropriate. From the vessel's base of operations, a telephone call will be placed to the Stranding Coordinator, NOAA National Marine Fisheries Service (NMFS), Southwest Region, Long Beach, to obtain instructions. Although NOAA has primary responsibility for marine mammals in both State and Federal waters, the California Department of Fish and Wildlife (CDFW) will also be advised that an incident has occurred in State waters affecting a protected species.	No adverse effects to marine mammals or sea turtles due to survey activities are observed.	Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Monitoring Report following comple-tion of survey.	3/30/18 TZ

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
MM BIO-9: Limitations on Survey Operations in Select Marine Protected Areas (MPAs).	All MPAs; prior to commencing survey activities, geophysical operators shall coordinate with the CLSC, California Department of Fish and Wildlife (CDFW), and any other appropriate permitting agency regarding proposed operations within MPAs. The scope and purpose of each survey proposed within a MPA shall be defined by the permit holder, and the applicability of the survey to the allowable MPA activities shall be delineated by the permit holder. If deemed necessary by CDFW, geophysical operators will pursue a scientific collecting permit, or other appropriate authorization, to secure approval to work within a MPA, and shall provide a copy of such authorization to the CSLC as part of the required presurvey notification to CSLC. CSLC, CDFW, and/or other permitting agencies may impose further restrictions on survey activities as conditions of approval.	No adverse effects to MPA resources due to survey activities are observed.	Monitor reactions of wildlife to survey operations; report on shutdown conditions and survey restart. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder; survey permitted by CDFW.	Prior to survey.	3/5/18 TE
MM HAZ-1: Oil Spill Contingency Plan (OSCP) Required Information.	Permittees shall develop and submit to CSLC staff for review and approval an OSCP that addresses accidental releases of petroleum and/or non-petroleum products during survey operations. Permittees' OSCPs shall include the following information for each vessel to be involved with the survey: • Specific steps to be taken in the event of a spill, including notification names, phone numbers, and locations of: (1) nearby emergency medical facilities, and (2) wildlife rescue/response organizations (e.g., Oiled Wildlife Care Network); • Description of crew training and equipment testing procedures; and • Description, quantities, and location of spill response equipment onboard the vessel.	Reduction in the potential for an accidental spill. Proper and timely response and notification of responsible parties in the event of a spill.	Documentation of proper spill training. Notification of responsible parties in the event of a spill.	OGPP permit holder and contract vessel operator.	Prior to survey.	3/5/18 TE
MM HAZ-2: Vessel fueling restrictions.	Vessel fueling shall only occur at an approved docking facility. No cross vessel fueling shall be allowed.	Reduction in the potential for an accidental spill.	Documentation of fueling activities.	Contract vessel operator.	Following survey.	3/30/18 TE
MM HAZ-3: OSCP equipment and supplies.	Onboard spill response equipment and supplies shall be sufficient to contain and recover the worst-case scenario spill of petroleum products as outlined in the OSCP.	Proper and timely response in the event of a spill.	Notification to CSLC of onboard spill response equipment/supplies inventory, verify	Contract vessel operator.	Prior to survey.	3/26/18 TE

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
			ability to respond to worst-case spill.			
MM HAZ-1: Oil Spill Contingency Plan (OSCP) Required Information.	Outlined under **Hazards and Hazardous Materials** (above)					
MM HAZ-2: Vessel fueling restrictions.	Outlined under **Hazards and Hazardous Materials** (above)					
MM HAZ-3: OSCP equipment and supplies.	Outlined under **Hazards and Hazardous Materials** (above)					
MM BIO-9: Limitations on Survey Operations in Select MPAs.	Outlined under **Biological Resources** (above)					
MM REC-1: U.S. Coast Guard (USCG), Harbormaster, and Dive Shop Operator Notification.	All California waters where recreational diving may occur; as a survey permit condition, the CSLC shall require Permittees to provide the USCG with survey details, including information on vessel types, survey locations, times, contact information, and other details of activities that may pose a hazard to divers so that USCG can include the information in the Local Notice to Mariners, advising vessels to avoid potential hazards near survey areas. Furthermore, at least twenty-one (21) days in advance of in-water activities, Permittees shall: (1) post such notices in the harbormasters' offices of regional harbors; and (2) notify operators of dive shops in coastal locations adjacent to the proposed offshore survey operations.	No adverse effects to recreational divers from survey operations.	Notify the USCG, local harbormasters, and local dive shops of planned survey activity. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Prior to survey.	3/26/18 TC

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
MM FISH-1: U.S. Coast Guard (USCG) and Harbormaster Notification.	All California waters; as a survey permit condition, the CSLC shall require Permittees to provide the USCG with survey details, including information on vessel types, survey locations, times, contact information, and other details of activities that may pose a hazard to mariners and fishers so that USCG can include the information in the Local Notice to Mariners, advising vessels to avoid potential hazards near survey areas. Furthermore, at least twenty-one (21) days in advance of in-water activities, Permittees shall post such notices in the harbormasters' offices of regional harbors.	No adverse effects to commercial fishing gear in place.	Notify the USCG and local harbormasters of planned survey activity. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Prior to survey.	3/5/18 TE
MM FISH-2: Minimize Interaction with Fishing Gear.	To minimize interaction with fishing gear that may be present within a survey area: (1) the geophysical vessel (or designated vessel) shall traverse the proposed survey corridor prior to commencing survey operations to note and record the presence, type, and location of deployed fishing gear (i.e., buoys); (2) no survey lines within 30 m (100 feet) of observed fishing gear shall be conducted. The survey crew shall not remove or relocate any fishing gear; removal or relocation shall only be accomplished by the owner of the gear upon notification by the survey operator of the potential conflict.	No adverse effects to commercial fishing gear in place.	Visually observe the survey area for commercial fishing gear. Notify the gear owner and request relocation of gear outside survey area. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Imme-diately prior to survey (prior to each survey day).	3/26/18 TE
MM FISH-1: USCG and Harbormaster Notification.	Outlined under **Commercial and Recreational Fisheries** (above)					

Acronyms/Abbreviations: CARB = California Air Resources Board; CDFW = California Department of Fish and Wildlife; CSLC = California State Lands Commission; dB = decibels; kHz = kilohertz; MPA = Marine Protected Area; MWCP = Marine Wildlife Contingency Plan; MWM = Marine Wildlife Monitor; m= meter(s); NOAA = National Oceanic and Atmospheric Administration; NO_x = Nitrogen Oxide; OGPP = Offshore Geophysical Permit Program; OSCP = Oil Spill Contingency Plan; USCG = U.S. Coast Guard